

NAME _____
PERIOD _____

SOIL: POROSITY AND PERMEABILITY LAB

INTRODUCTION

WHILE SOME PRECIPITATION FALLS TO THE EARTH AND RUNS OFF INTO STREAMS AND RIVERS, ANOTHER PORTION SEEPS SLOWLY THROUGH THE SOIL INTO THE UPPER LAYERS OF THE EARTH'S CRUST. THIS UNDERGROUND WATER, OR GROUNDWATER, FILLS THE EMPTY SPACES OF PORES BETWEEN ROCK AND SOIL PARTICLES. SUBSURFACE ROCK AND SEDIMENT UNITS THROUGH WHICH LARGE VOLUMES OF WATER CAN FLOW AND BE STORED ARE CALLED AQUIFERS. HOW WATER TRAVELS THROUGH THESE AQUIFERS IS DETERMINED BY A NUMBER OF FACTORS.

TWO MAJOR FACTORS AFFECTING GROUNDWATER MOVEMENT ARE PERMEABILITY AND POROSITY.

POROSITY IS THE PERCENTAGE OF OPEN PORE SPACES IN A GIVEN VOLUME OF ROCK OR SEDIMENT, AND DETERMINES THE TOTAL AMOUNT OF WATER A MATERIAL WILL HOLD. THE LARGER THE VOLUME OF PORE SPACES, THE HIGHER ITS POROSITY, AND THE MORE WATER IT CAN HOLD. POROSITY IS LARGELY INFLUENCED BY FACTORS OF PARTICLE SIZE, SHAPE, ASSORTMENT, AND COMPACTION.

PERMEABILITY REFERS TO THE ABILITY OF A ROCK OR SEDIMENT TO TRANSMIT WATER FREELY. THE RATE AT WHICH A MATERIAL TRANSMITS WATER DEPENDS NOT ONLY ON ITS TOTAL POROSITY, BUT ALSO ON THE SIZE OF THE PASSAGEWAYS BETWEEN ITS OPENINGS. TO BE CONSIDERED PERMEABLE, THE OPEN SPACES IN A ROCK MUST BE CONNECTED. THE SIZE AND SORTING OF THE PARTICLES COMPOSING THE ROCK OR SEDIMENT WILL AFFECT ITS PERMEABILITY. GENERALLY, MATERIALS OF LARGER PARTICLE SIZE, WHICH ARE WELL SORTED, WILL BE MORE PERMEABLE.

OBJECTIVES

TO EXPLORE THE CONCEPTS OF POROSITY AND PERMEABILITY BY OBSERVING WHAT EFFECT PARTICLE SIZE AND SHAPE HAVE ON THE AMOUNT OF WATER THAT CAN BE HELD IN THE OPEN SPACES BETWEEN PARTICLE, AND ALSO HOW THESE TWO FACTORS IMPACT THE RATE OF WATER FLOW.

IN THE FIRST PART OF THIS ACTIVITY YOU WILL DEVISE AN EXPERIMENT TO DETERMINE THE POROSITY OF SOIL SAMPLES.

IN THE SECOND PART OF THIS ACTIVITY YOU WILL DEVISE AN EXPERIMENT TO DETERMINE THE EFFECTS OF PARTICLE SIZE ON THE PERMEABILITY OF SOIL SAMPLES.

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POROSITY AND PERMEABILITY PRE-LAB

DEFINE POROSITY:

HOW DO YOU CALCULATE POROSITY?

HOW WILL YOU TEST YOUR SOIL SAMPLE FOR POROSITY?

LIST THE MATERIALS YOU WILL USE AND DRAW A PICTURE OF YOUR SET-UP.

DATA COLLECTION (PLEASE WRITE ALL RAW DATA IN YOUR LAB BOOK)

POROSITY

PERMEABILITY

LAB QUESTIONS:

1. WHICH SOIL SAMPLE HAD THE GREATER POROSITY? WHICH SOIL SAMPLE HAD THE GREATER PERMEABILITY? WHAT IS THE RELATIONSHIP BETWEEN POROSITY AND PERMEABILITY?
2. HOW DO THESE FACTORS AFFECT THE GROWTH OF PLANTS? PLEASE EXPLAIN YOUR ANSWER.
3. COMMENT ON THE POROSITY AND PERMEABILITY OF YOUR ECOCOLUMN.
4. EXTENSION: WHAT WOULD YOU CHANGE IF YOU DID THIS EXPERIMENT AGAIN?